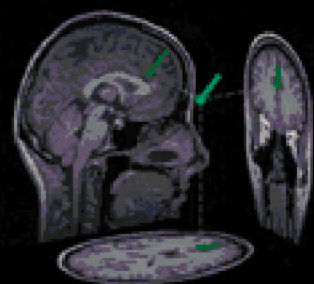




DARPA-NGA Industry Day

Revolutionary Imagery Analysis through Neurocognitive Techniques



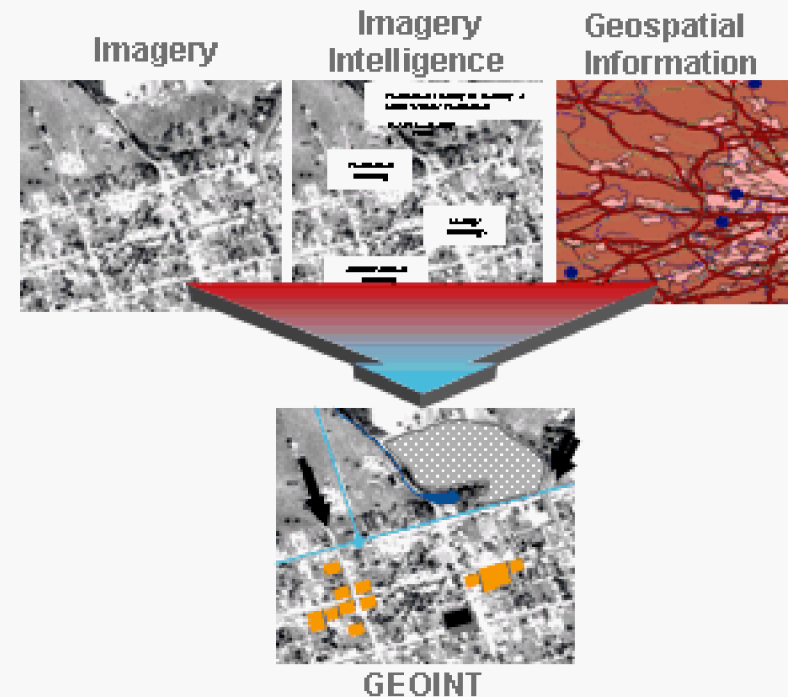
Dr. Amy Kruse
DARPA/DSO
amy.kruse@darpa.mil





► Why Neuroscience?

- Analysis is a complex cognitive activity
- Analysis is done in the context of ancillary/collateral information





Problem



- Imagery analysts are currently faced with an enormous volume of data, which is growing exponentially as new collection platforms are added.
- Analysis is done by a finite number of specially trained analysts, and only a small fraction of imagery data collected is actually analyzed with today's systems.
- New collection platforms coming online will mandate a revolution in IA tradecraft and image handling.
- Despite substantial investment, computer vision efforts have failed to recreate the accuracy and flexibility of the human visual system.

NGA Imagery Analysis

- **Exploitation Focus**
 - **Monitor & Watch Critical Issues**
 - warning
 - sustain awareness
 - **Detailed Analysis of Hard Targets**
 - find and monitor
 - in-depth research
 - **Support Decisionmaking & Operations**
 - tailored support





► Challenges

- **Accumulated knowledge and experience within the IA community is often lost**
 - Is there a way to capture, manage and retain these critical details?
- **IA tradecraft has not been systematically codified**
 - Is there a way to understand the analytic process that gets beyond subjective measures alone?
- **An “IA-centric” approach to the design of systems is badly needed**
 - The IA is human capital of NGA – how can we enable them to do their job more effectively?



► Goal

- Efforts should:
 - Assist IAs with reaching **NEW** analytic insights
 - *Rapid insights with increased confidence*
 - Create novel tools for **DISCOVERY** of new information and patterns
 - *Tools that help synthesize, not just create a more complicated interface*
 - *Support the new forms of imagery now available (non-literal)*



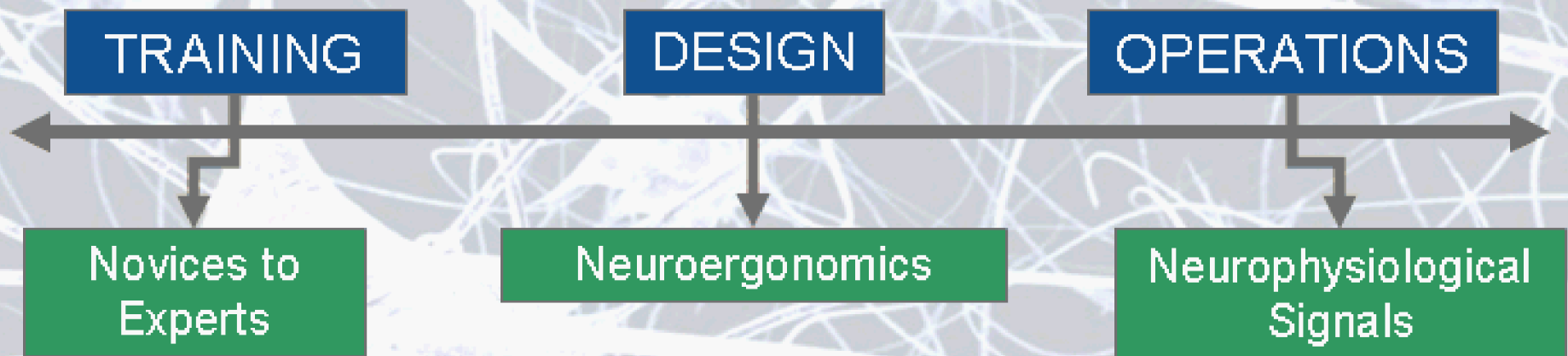
► First Steps

- **Understanding the analytic process**
 - We now have tools and techniques from neuroscience, cognitive science, human factors and psychology that can enable a greater understanding of these processes
 - Add metrics to a formerly subjective process
 - We hypothesize that like other complex decision making tasks, there are fundamental cognitive building blocks that enable analytical insights and pattern recognition
 - If we can uncover these fundamental pieces, we can begin to train to these specific cognitive skills

Operational Neuroscience!



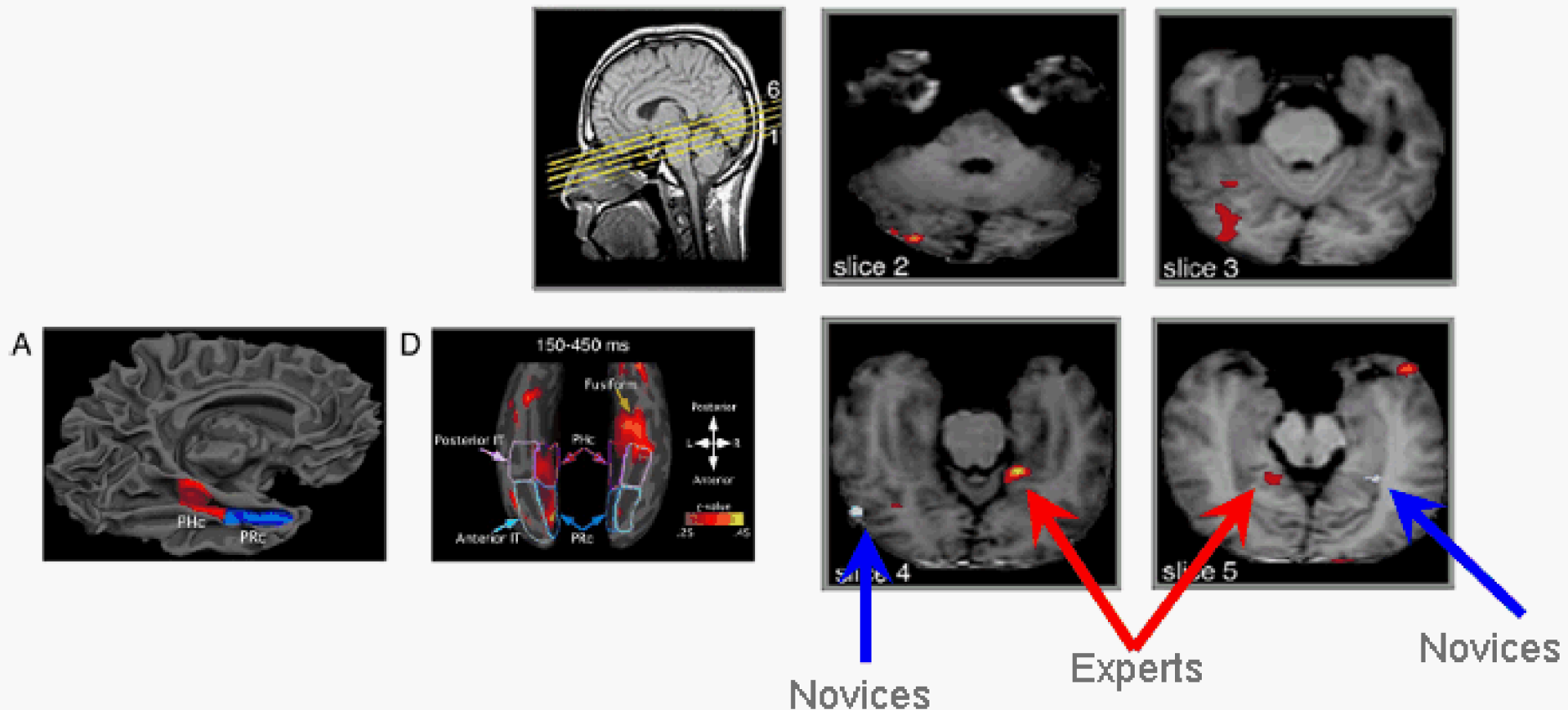
► The Continuum of Operational Neuroscience...





► Training: Novice to Expert

Brain differences during skill development





► Design: Neuroergonomics

- **21st Century Human Factors**
 - Takes into account the cognitive load a particular interface places on the user
- **Adaptive displays**
- **Cross-modal representation**

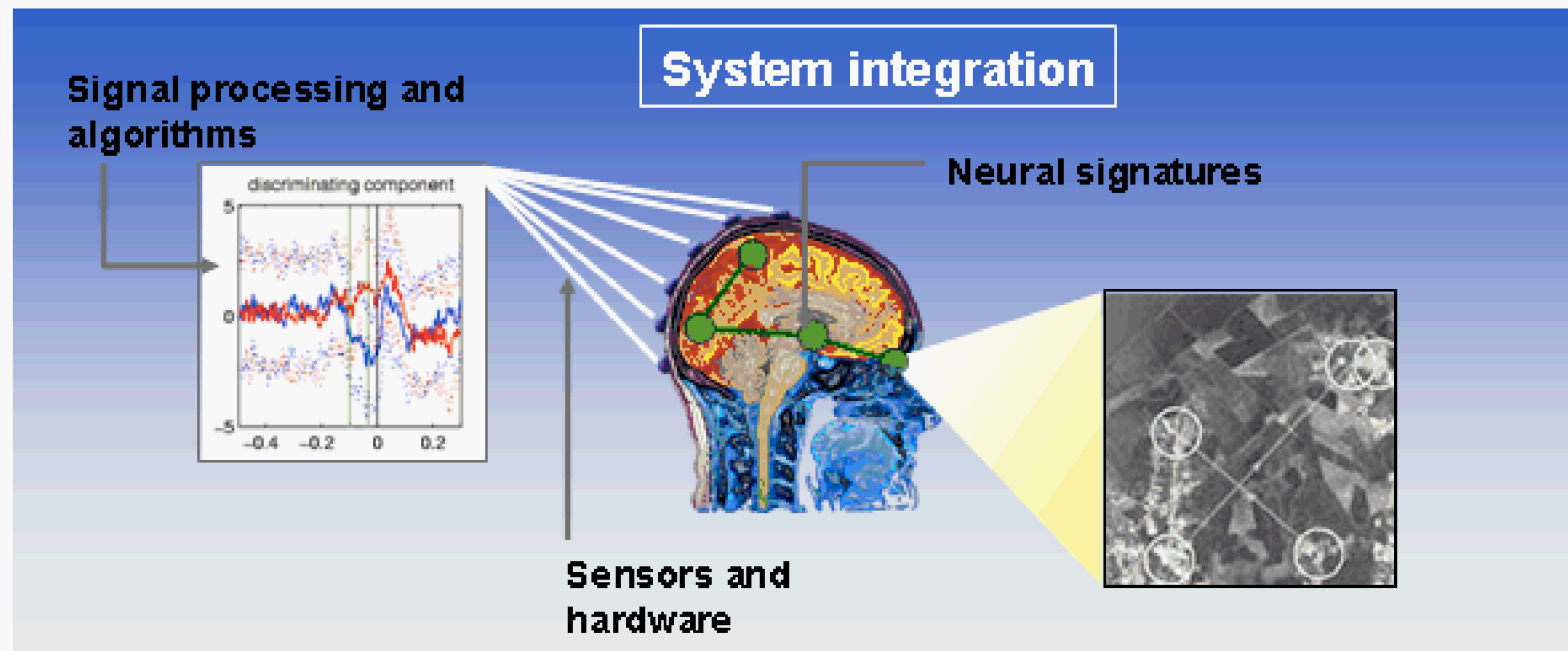




► Operations: Evoked Neural Signals

NIA Model

- Imagery triage via neural signals of target detection





► What can YOU do?

- **Multidisciplinary teaming can uncover the neural bases and apply the discoveries**
 - **NIA model**
 - Academia: basic science
 - Industry/Small Business: domain knowledge/application
 - **A new generation of IAs**
 - Capturing interest
 - Integrated tools for training diverse skills